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Neighbourhood Environmental Health: Relationship between Neighbourhood Quality, Physical Activity and Health

Siti Nur Afiqah Mohamed Musthafa[1,2], Oliver Ling Hoon Leh*[1], Marlyana Azyyati Marzukhi[1], Ahmad Zharif Ahmad Zahir[1], Weng Yinxue[3]

[1]Environment and Social Health Research Group, College of Built Environment, Universiti Teknologi Mara, Malaysia.
[2]Public Service Department, Malaysia.
[3]Guangzhou City Construction College, Guangzhou, Guangdong, China.

*Corresponding Author: oliver3979@uitm.edu.my

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ABSTRACT

Human health, especially the non-communicable diseases (NCDs) was associated with the quality of neighbourhood environments. NCDs are also related to the level of physical activity, which can be influenced by the quality of the neighbourhood environment. However, past research has focused on public perception without being verified by researchers' on-site observation of the neighbourhood environment. This research aims to analyse the three relationships among neighbourhood environment, physical activity level, and health. It involves a questionnaire survey for the perception of the neighbourhood environment, self-reported health status, and engagement in physical activity, as well as on-site observation. Correlation and multiple regression models are applied for the analysis. As a result, this research uses a case study in USJ, Subang Jaya, to suggest a significant relationship between neighbourhood environment and health and physical activity level and health. However, the relationship between neighbourhood environment and physical activity is not significant. The multiple regression analysis for health status shows that 89.7% of the variance is due to other variables. The findings will be beneficial to all parties involved in urban planning and design in order to improve environmental quality and encourage physical activity for better health.

1.0 INTRODUCTION

Environmental health comprises aspects of human health and diseases that are determined by factors in the environment. It also refers to the theory and practice of assessing and controlling factors in the environment that can potentially affect health (WHO-Europe, 2007). Since around 60% of urban residents live in a planned neighbourhood area (UN DESA, 2022), health is potentially affected by the quality of the neighbourhood environment, especially the provision of green or recreational areas and friendliness for physical activities.

Non-communicable diseases (NCDs) are the leading cause of death worldwide. In 2016, NCDs were responsible for 71% of the 57 million deaths globally (WHO, 2022). In Malaysia, NCDs contribute to 71% of premature deaths. The Malaysian Burden of Disease and Injury Study (2009-2014) showed that cardiovascular and circulatory diseases were consistently the largest contributors to death in Malaysia from 2009 until 2014 (Institute for Public Health, National Institutes of Health (NIH), 2019). Data from the previous National Health and Morbidity Survey (NHMS) in the years 2011, 2015, and 2019 showed an increasing trend for diabetes and a plateaued trend for hypertension. The prevalence of diabetes ranged from 11.2% (2011) to 13.4% (2015) and 18.3% (2019), and hypertension from 32.7% (2011) to 30.3% (2015) and 30.0% (2019) (NIH, 2019).

Most of the previous research focused on public perceptions when examining the neighbourhood environment without verification by researchers via on-site observation. Furthermore, there is less research targeted to carry out a single study to cover the three relationships among neighbourhood environment, physical activity, and human health. With that, this new empirical research was carried out to examine three relationships among the neighbourhood environment (respondents'perceptions and researchers' observations), physical activity, and health (NCD) by applying correlation and multiple regression models.

2.0 LITERATURE REVIEW

The neighbourhood environment has been associated with the health status of mental and physical health outcomes resulting from 14 perspectives of housing quality, area deprivation, safety/crime, industrial pollutants, and other factors (Rachele et al., 2019). Neighbourhood built environment characteristics are important for supporting different types of neighbourhood-based physical activity (McCormack, 2017). In the 2006 study, the World Health Organisation (WHO) included built environments, including housing, land use patterns, and roads, as environmental factors that are modifiable, and later in 2016, they highlighted behaviour related to environmental factors, such as the availability of safe water for washing hands or physical activity fostered through improved urban design, as one of the inclusions in the environmental study. Furthermore, even the type of neighbourhood or housing also affects the physical, mental, social, and atmospheric health of people, as shown in a study of villas and apartments in Iran (Sayedeh and Reyhaneh, 2016).

Anderson (2021), in the review of neighbourhood environmental factors, identified that they can be considered to have both a direct and indirect impact on wellbeing through physical activity and social connectedness. Built environment characteristics, in particular sidewalks and facilities, within 1.6 kilometres of home could encourage higher overall levels of neighbourhood-based physical activity in adults (McCormack, 2017). Song et al. (2020) found that having parks, green spaces, or exercise facilities at a shorter distance may lead to an increased level of recreational physical activity due to the convenience of proximate facilities. The level of physical activity can be influenced by land use and urban area design (Siti Nur Afiqah et al., 2015) as well as park quality (Rosli et al., 2020). While many studies on green space and health use the amount of green space as the key indicator, there are increasing indications that the accessibility, type, quality, and context of green space should also be considered in the assessment of relationships between green space and human health and well-being (Kruize et al., 2019).

Based on a study in New Zealand, physical activity levels reduced the risks of poor mental health and cardiovascular disease (CVD), with significant relationships at a 95% confidence level. In addition, individuals residing in neighbourhoods with more than 15% green space coverage had similarly reduced CVD risks. In contrast, the risks of poor general health or being overweight were not reduced in greener neighbourhoods (Richardson et al., 2013). Meanwhile, the least green neighbourhoods have certain other characteristics (e.g., high population density or urban centres) that also relate to CVD risk (Richardson et al., 2013). Living in proximity to urban green space is generally associated with increased physical activity, positive health behaviours, and improved health and well-being outcomes (Nath et al., 2018).

Furthermore, it is known that lack of exercise, high stress, and high levels of pollution are associated with the development of obesity and heart disease, asthma, diabetes, and some cancers. Investing in and protecting urban green spaces means a boost for physical activity and recreational pursuit as necessary to prevent such health problems (Cicea & Pirlogea, 2011).

It has been highlighted that physical activity has a significant impact on health. Particularly for adults, doing 30 minutes of at least moderate-intensity physical activity at least five days a week helps prevent and control over 20 chronic conditions, such as coronary heart disease, stroke, type 2 diabetes, cancer, obesity, mental health issues, and musculoskeletal disorders (Mang, 2013; Miles, 2007).

However, most of the previous studies took into consideration public perceptions in examining the neighbourhood environment and its relation to physical activities and health without verification by researchers' on-site observations. It is necessary to examine the neighbourhood environment based on both researchers' on-site observations and residents' perceptions, and its relation to the physical activity level and self-reported health condition. This is because individual perceptions may be influenced by their experience, awareness, and socio-economic parameters.

3.0 METHODOLOGY

This study focuses on environmental health, the relationship between neighbourhood environment, physical activity, and self-reported health conditions of NCDs, which include diabetes, high blood pressure, and heart diseases (Figure 1). The study applied the methodology of a case study with quantitative and qualitative methods (mixed methods), as shown in Figure 2. The relationship was analysed using correlation and multiple regression. An urban settlement, known as USJ, was chosen as the case study for the research. The settlement is administered by the Subang Jaya City Council. It is one of the planned housing areas that applies a neighbourhood concept (Figure 3) in Selangor, Malaysia. In total, 19 neighbourhoods within the USJ were involved in this research.

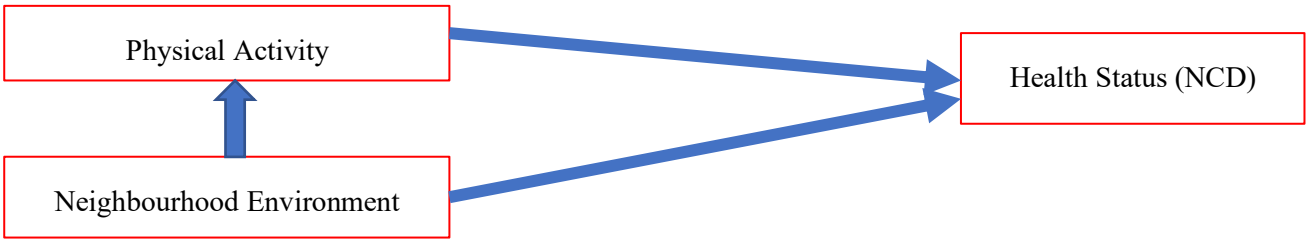

Figure 1. Scope of study.

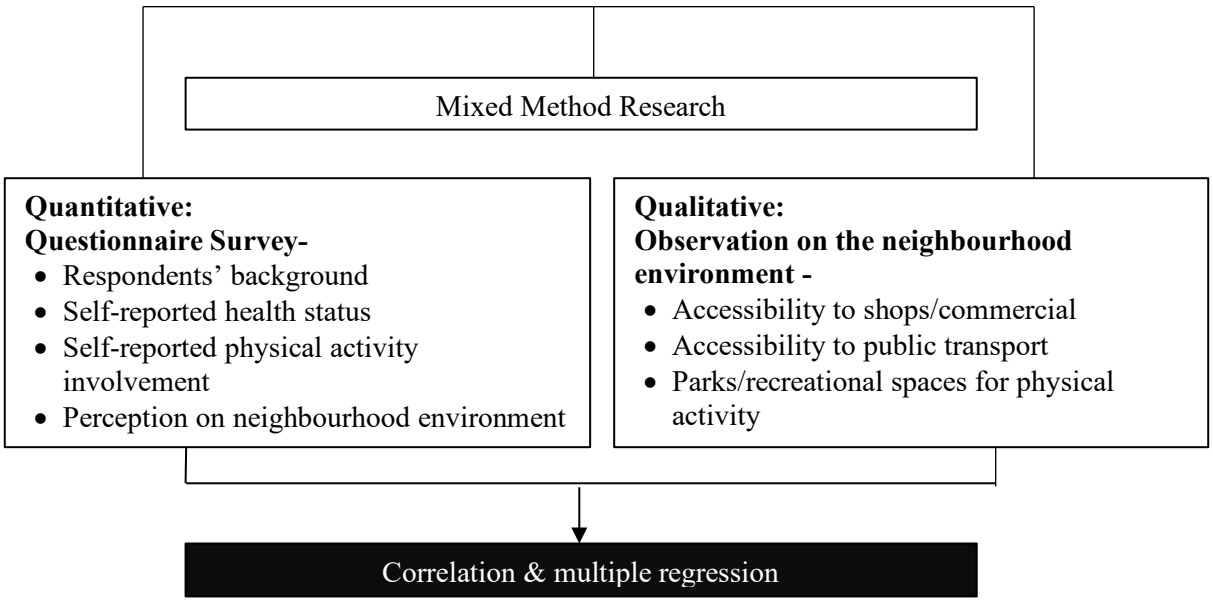

Figure 2. Methodology of the research.

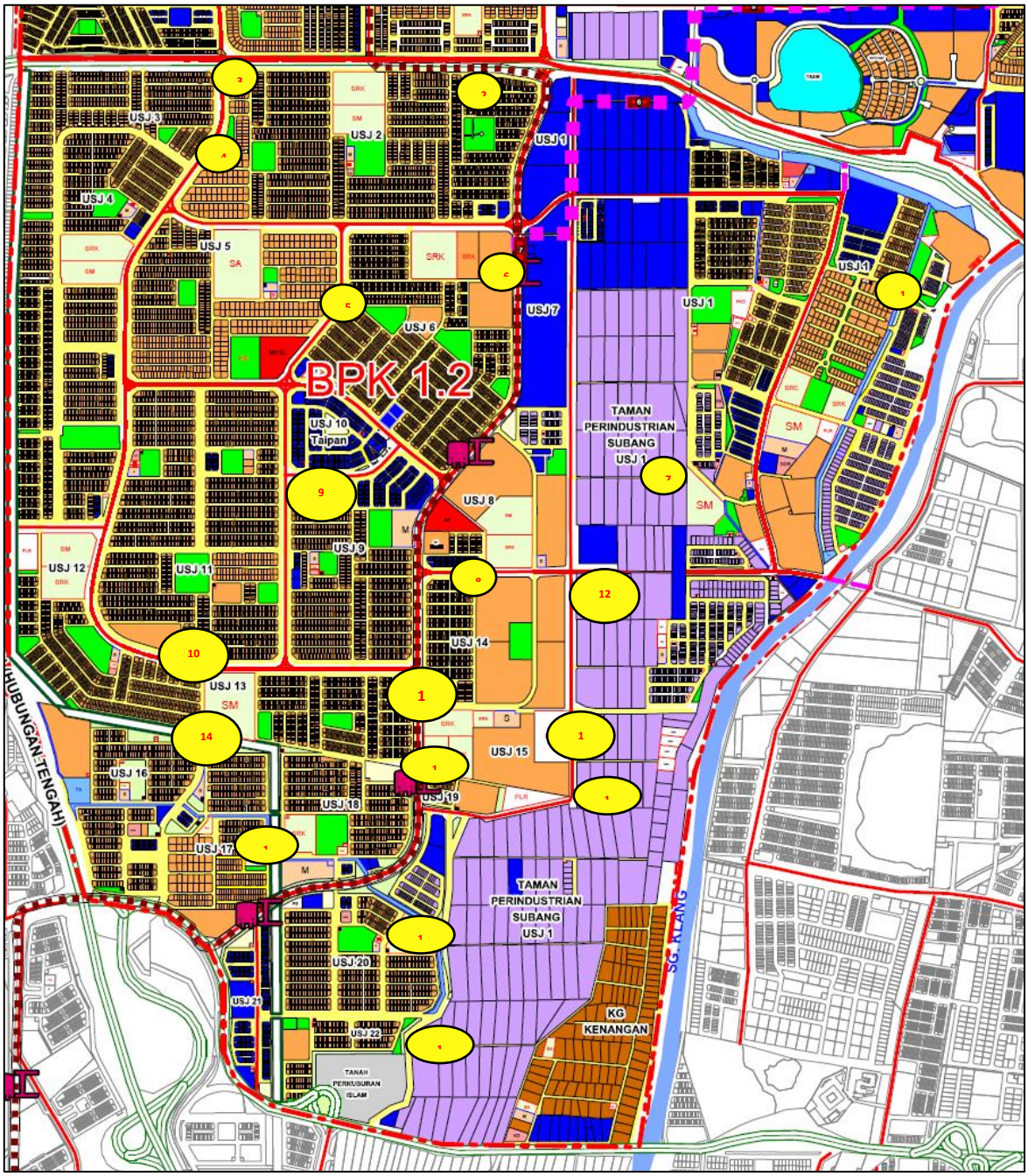

Figure 3. Study area – the chosen 19 neighbourhoods in USJ, Subang Jaya, State of Selangor, Malaysia. (Source: MBSJ, 2021)

The associations of the independent variables with the dependent variable were tested using multiple regression analysis. The regression analysis was conducted for the effect of human health status and factors with the level of physical activity and the neighbourhood environment. The regression equation for the full model is:

$$y = a + b_1X_1 + b_2X_2$$
$$y = 2.210 + 0.003*X_1 + 0.327*X_2$$

Where,

a = Intercepts
y = Health Status
b_1X_1 = Physical Activity
b_2X_2 = Neighbourhood Environment

3.1. Questionnaire survey and sampling of respondents

As stated by Van Oyen et al. (1997), information on ill health and lifestyles is best collected through the questionnaire sampling survey. Thus, the questionnaire form was designed to collect information from respondents for the purpose of identifying their physical activity, health conditions, perceptions of the neighbourhood environment, and background. Using the stratified random sampling technique, 385 respondents from a total population of 156,011 in Subang Jaya were chosen within the 19 neighbourhoods in USJ, Subang Jaya. The sample size was determined according to a 95% confidence level and an error of 5%. The respondents consisted of males and females, different ethnic groups, income levels, and BMI status (Table 1).

Table 1. Background of Respondents

Respondent Personal Information		Frequency	Percent
Gender	Female	113	29.4
	Male	272	70.6
Ethnic	Malay	159	41.3
	Chinese	146	37.9
	Indian	75	19.5
	Others	5	1.3
Age	Less than 20 years old	55	14.3
	20 – 30 years old	104	27.0
	31 – 40 years old	46	11.9
	41 – 50 years old	66	17.1
	Above 50 years old	114	29.6
BMI Status	Underweight < 18.5	24	6.2
	Normal 18.5 – 24.9	225	58.4
	Overweight 25 - 30	101	26.2
	Obese > 30	35	9.1
Monthly Income	Less than RM2,000	110	28.6
	RM2,000 – RM3,999	58	15.1
	RM4,000 – RM5,999	63	16.4
	RM6,000 – RM7,999	31	8.1
	RM8,000 – RM9,999	13	3.4
	RM10,000 and above	21	5.5
	Total	**385**	**100.0**

3.2. On-site observation

A non-participatory observation method was chosen. The elements observed were pedestrian accessibility to shops, pedestrian accessibility to public transport, and the condition of recreational spaces and parks for physical activities. This was carried out by researchers who were professionals in the built environment, which included urban planners, designers, and park managers.

4.0 RESULTS AND DISCUSSION

4.1. Neighbourhood environment

The examination of the neighbourhood environment was focused on parameters that may affect the physical activity level of the respondents. Based on the respondents' perceptions (as shown by the questionnaire survey data in Table 2), among the 19 neighbourhoods, there were nine neighbourhoods, i.e., USJ 1, 3, 4, 6, 11, 14, 15, 16, and 22, that showed more than 80% of the respondents agreed or strongly agreed that many shops, stores, or markets were within easy walking/cycling distance from their houses. From the

aspect of accessibility to shop facilities, it can encourage people to be more physically active by walking or cycling within these nine neighbourhoods as compared to other neighbourhoods, which might not encourage people to walk or cycle for commercial trips.

Table 2. Shops, Stores, or Markets within Easy Walking/Cycling Distance from Houses

Sections	SD %	D %	N %	A %	SA %	Total %
USJ 1	0 (0.0)	4 (8.5)	0 (0.0)	**38** **(80.9)**	5 (10.6)	47 (100.0)
USJ 2	1 (3.1)	13 (40.6)	4 (12.5)	10 (31.3)	4 (12.5)	32 (100.0)
USJ 3	1 (3.3)	3 (10.0)	1 (3.3)	**25** **(83.3)**	0 (0.0)	30 (100.0)
USJ 4	0 (0.0)	0 (0.0)	0 (0.0)	**16** **(88.9)**	2 (11.1)	18 (100.0)
USJ 5	0 (0.0)	11 (40.7)	4 (14.8)	12 (44.4)	0 (0.0)	27 (100.0)
USJ 6	0 (0.0)	1 (2.5)	0 (0.0)	**32** **(80.0)**	7 (17.5)	40 (100.0)
USJ 8	0 (0.0)	0 (0.0)	0 (0.0)	9 (52.9)	8 (47.1)	17 (100.0)
USJ 9	0 (0.0)	2 (12.5)	0 (0.0)	12 (75.0)	2 (12.5)	16 (100.0)
USJ 11	0 (0.0)	3 (8.3)	1 (2.8)	**29** **(80.6)**	3 (8.3)	36 (100.0)
USJ 12	0 (0.0)	5 (45.5)	0 (0.0)	4 (36.4)	2 (18.2)	11 (100.0)
USJ 13	1 (5.6)	6 (33.3)	1 (5.6)	10 (55.6)	0 (0.0)	18 (100.0)
USJ 14	0 (0.0)	0 (0.00)	0 (0.0)	**19** **(86.4)**	3 (13.6)	22 (100.0)
USJ 15	0 (0.0)	0 (0.00)	0 (0,0)	**5** **(100.0)**	0 (0.0)	5 (100.0)
USJ 16	0 (0.0)	0 (0.00)	1 (6.7)	**13** **(86.7)**	1 (6.7)	15 (100.0)
USJ 17	0 (0.0)	2 (16.7)	0 (0.0)	8 (66.7)	2 (16.7)	12 (100.0)
USJ 18	1 (14.3)	2 (28.6)	0 (0.0)	4 (57.1)	0 (0.0)	7 (100.0)
USJ 19	0 (0.0)	2 (11.8)	0 (0.0)	13 (76.5)	2 (11.8)	17 (100.0)
USJ 20	2 (22.2)	0 (0.0)	0 (0.0)	4 (44.4)	3 (33.3)	9 (100.0)
USJ 22	0 (0.0)	0 (0.0)	0 (0.0)	**6** **(100.0)**	0 (0.0)	6 (100.0)
Total	**6** **(1.6)**	**54** **(14.0)**	**12** **(3.1)**	**269** **(69.9)**	**44** **(11.4)**	**385** **(100.0)**

Note: SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

To verify the perception data, an on-site observation was carried out. For instance, there are hypermarkets (Giant and Mydin), shopping malls (Summit and Damen), and shops within walking distances and connected via pedestrian walkways in USJ 1 (Figures 4 and 5).

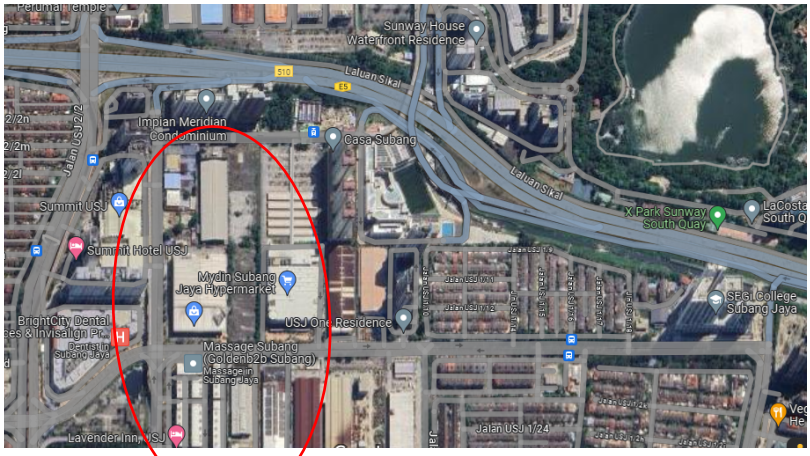

Figure 4. Availability of hypermarkets, shopping malls, and shops within USJ 1. (Source: Google maps, 2023)

Figure 5. Pedestrian walkways increase accessibility to shops/commercial areas in USJ 1. (Source: Google maps, 2023)

In contrast, USJ 2 had a lower satisfaction rate due to its accessibility to shops or commercial areas, with only two rows of shops on the eastern side of the neighbourhood (**Figure 6**). It is far for most of the residents in USJ 2, especially those that are staying on the western side.

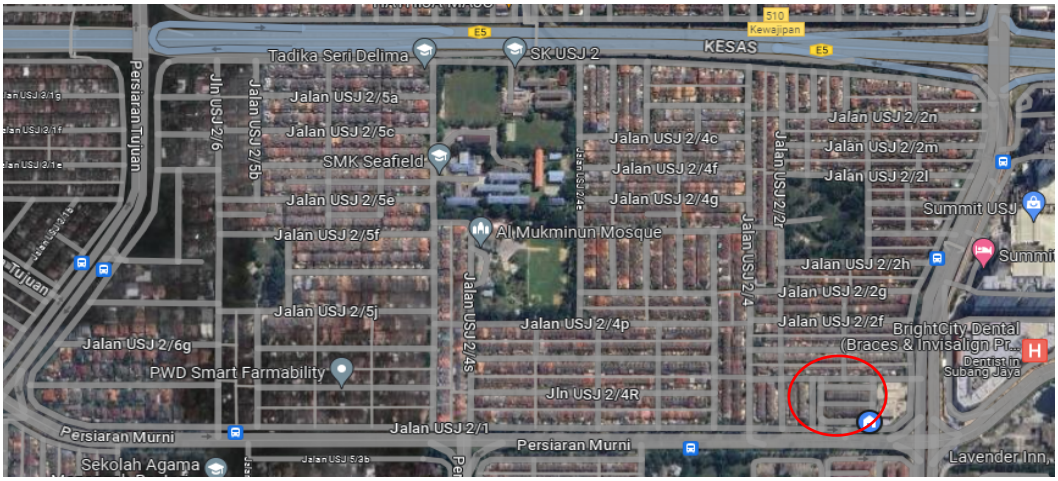

Figure 6. USJ 2 - shops are only located on the eastern side, far from houses located on the west. (Source: Google maps, 2023)

For pedestrian accessibility to public transport, USJ 6, 8, and 14 were rated most satisfied by the respondents (Table 3). These areas, which are less gated and guarded, have a higher level of accessibility for pedestrians to take public transport. Pedestrians have more short cuts to the bus stop.

Sections USJ 19 to 22 were rated the most unsatisfied by respondents (**Table 3**). These are mostly gated and guarded neighbourhoods (refer to Figure 7), which limit the accessibility of pedestrians, even for the Light Rail Transit (LRT) and bus services that are provided in the vicinity.

Table 3. Transit Stops (e.g., Bus) Within a 10-15 Minute Walk from Houses.

Sections	SD %	D %	N %	A %	SA %	Total %
USJ 1	0 (0.0)	5 (10.6)	1 (2.1)	36 (76.6)	5 (10.6)	47 (100)
USJ 2	0 (0.0)	5 (15.6)	6 (18.8)	15 (46.9)	6 (18.8)	32 (100)
USJ 3	0 (0.0)	3 (10.3)	0 (0.0)	26 (89.7)	0 (0.0)	29 (100)
USJ 4	0 (0.0)	1 (5.6)	0 (0.0)	15 (83.3)	2 (11.1)	18 (100)
USJ 5	0 (0.0)	2 (7.4)	3 (11.1)	22 (81.5)	0 (0.0)	27 (100)
USJ 6	0 (0.0)	1 (2.5)	0 (0.0)	**29 (72.5)**	**10 (25.0)**	40 (100)
USJ 8	0 (0.0)	0 (0.0)	0 (0.0)	**8 (47.1)**	**9 (52.9)**	17 (100)
USJ 9	0 (0.0)	5 (31.3)	0 (0.0)	9 (56.3)	2 (12.5)	16 (100)
USJ 11	0 (0.0)	1 (2.8)	1 (2.8)	31 (86.1)	3 (8.3)	36 (100)
USJ 12	0 (0.0)	5 (45.5)	0 (0.0)	4 (36.4)	2 (18.2)	11 (100)
USJ 13	1 (5.6)	2 (11.1)	1 (5.6)	13 (72.2)	1 (5.6)	18 (100)
USJ 14	0 (0.0)	0 (0.0)	0 (0.0)	**19 (86.4)**	3 (13.6)	22 (100)
USJ 15	0 (0.0)	0 (0.0)	0 (0.0)	**5 (100.0)**	0 (0.0)	5 (100)
USJ 16	0 (0.0)	6 (40.0)	3 (20.0)	6 (40.0)	0 (0.0)	15 (100)
USJ 17	0 (0.0)	4 (33.3)	0 (0.0)	6 (50.0)	2 (16.7)	12 (100)
USJ 18	0 (0.0)	6 (85.7)	0 (0.0)	1 (14.3)	0 (0.0)	7 (100)
USJ 19	0 (0.0)	2 (11.8)	4 (23.5)	9 (52.9)	2 (11.8)	17 (100)
USJ 20	2 (22.2)	0 (0.0)	1 (11.1)	4 (44.4)	2 (22.2)	9 (100)
USJ 22	0 (0.0)	4 (66.7)	0 (0.0)	2 (33.3)	0 (0.0)	6 (100)
Total	**3 (0.8)**	**52 (13.5)**	**20 (5.2)**	**260 (67.7)**	**49 (12.8)**	**384 (100)**

Note: SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Figure 7. USJ 20 is a gated and guarded neighbourhood. Arrow shows that the fence blocks the pedestrian access to the main road or public transport.
(Souce: adapted from Google, 2023)

In terms of public spaces or areas for physical activities, USJ 9 and 11 were rated the most satisfied by respondents (**Table 4**). These two neighbourhoods are well planned, with recreational areas that are suitable for jogging and playing games such as football and futsal. These recreational areas are well maintained and safe (**Figure 8**). USJ 19 was rated the most unsatisfied by respondents. It is lacking a recreational area. Beside USJ 19, the recreational space at USJ 18 is not well maintained (**Figure 9**).

Table 4. Parks, recreational spaces, and walking trails are safe and well maintained.

Sections	SD %	D %	N %	A %	SA %	Total %
USJ 1	1 (2.1)	15 (31.9)	7 (14.9)	22 (46.8)	2 (4.3)	47 (100)
USJ 2	0 (0.0)	1 (3.1)	13 (40.6)	14 (43.8)	4 (12.5)	32 (100)
USJ 3	0 (0.0)	7 (23.3)	3 (10.0)	19 (63.3)	1 (3.3)	30 (100)
USJ 4	0 (0.0)	5 (27.8)	2 (11.1)	11 (61.1)	0 (0.0)	18 (100)
USJ 5	0 (0.0)	4 (14.8)	9 (33.3)	13 (48.1)	1 (3.7)	27 (100)
USJ 6	1 (2.5)	0 (0.0)	2 (5.0)	29 (75.5)	8 (20.0)	40 (100)
USJ 8	0 (0.0)	13 (76.5)	0 (0.0)	4 (23.5)	0 (0.0)	17 (100)
USJ 9	0 (0.0)	0 (0.0)	0 (0.0)	**12** **(75.0)**	**4** **(24.0)**	16 (100)
USJ 11	0 (0.0)	0 (0.0)	0 (0.0)	**31** **(86.1)**	5 (13.9)	36 (100)
USJ 12	0 (0.0)	0 (0.0)	0 (0.0)	10 (90.9)	1 (9.1)	11 (100)
USJ 13	1 (5.6)	2 (11.1)	0 (0.0)	13 (72.2)	2 (11.1)	18 (100)
USJ 14	2 (9.1)	6 (27.3)	2 (9.1)	10 (45.5)	2 (9.1)	22 (100)
USJ 15	0 (0.0)	5 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	5 (100)
USJ 16	0 (0.0)	4 (26.7)	1 (6.7)	10 (66.7)	0 (0.0)	15 (100)
USJ 17	0 (0.0)	1 (9.1)	1 (9.1)	7 (63.6)	2 (18.2)	11 (100)

USJ 18	0 (0.0)	1 (14.3)	2 (28.6)	4 (57.1)	0 (0.0)	7 (100)
USJ 19	8 (47.1)	5 (29.4)	0 (0.0)	4 (23.5)	0 (0.0)	17 (100)
USJ 20	0 (0.0)	1 (11.1)	0 (0.0)	5 (55.6)	3 (33.3)	9 (100)
USJ 22	0 (0.0)	0 (0.0)	0 (0.0)	6 (100.0)	0 (0.0)	6 (100)
Total	**13 (3.4)**	**70 (18.2)**	**42 (10.9)**	**224 (58.3)**	**35 (9.1)**	**384 (100)**

Note: SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Figure 8. Recreational areas/parks at USJ 11 that are well planned and safe for multi-activities. (Source: Author)

Figure 9. Pathway and parks at USJ 18 that are not well maintained. (Source: Author)

4.2. Physical activities

Physical activity is defined as any bodily movement produced by skeletal muscle that requires energy expenditure. The involvement of respondents in vigorous and moderate levels of activities was identified through the questionnaire survey as self-reported. **Table 5** shows the involvement of respondents in vigorous physical activity by neighbourhoods. USJ 9, 11, 12, 17, and 20 were among the most active neighbourhoods in USJ, with all respondents involved in vigorous activities for more than 6 days within 14 days. The most inactive neighbourhood was USJ 2, with 56.3% of respondents not carrying out any vigorous activity within 14 days.

Table 5. Frequency of Vigorous Activities Carried Out in 14 Days.

Sections	1-2 days	%	3-4 days	%	5-6 days	%	> 6 days	%	0 days	%	Total	%
USJ 1	2	4.3%	5	10.6%	0	0.0%	37	78.7%	3	6.4%	47	100%
USJ 2	7	21.9 %	3	9.4%	2	6.3%	2	6.3%	18	**56.3%**	32	100%
USJ 3	2	6.7%	2	6.7%	2	6.7%	23	76.7%	1	3.3%	30	100%
USJ 4	0	0.0%	2	11.1%	2	11.1%	14	77.8%	0	0.0%	18	100%
USJ 5	2	7.4%	4	14.8%	3	11.1%	15	55.6%	3	11.1%	27	100%
USJ 6	1	2.5%	0	0.0%	0	0.0%	39	97.5%	0	0.0%	40	100%
USJ 8	1	5.9%	7	41.2%	1	5.9%	7	41.2%	1	5.9%	17	100%
USJ 9	0	0.0%	0	0.0%	0	0.0%	16	**100.0 %**	0	0.0%	16	100%
USJ 11	0	0.0%	0	0.0%	0	0.0%	36	**100.0 %**	0	0.0%	36	100%
USJ 12	0	0.0%	0	0.0%	0	0.0%	11	**100.0 %**	0	0.0%	11	100%
USJ 13	1	5.6%	0	0.0%	0	0.0%	17	94.4%	0	0.0%	18	100%
USJ 14	1	4.5%	3	13.6%	3	13.6%	11	50.0%	4	18.2%	22	100%
USJ 15	0	0.0%	2	40.0%	0	0.0%	2	40.0%	1	20.0%	5	100%
USJ 16	2	13.3 %	1	6.7%	0	0.0%	11	73.3%	1	6.7%	15	100%
USJ 17	0	0.0%	0	0.0%	0	0.0%	12	**100.0 %**	0	0.0%	12	100%
USJ 18	1	14.3 %	0	0.0%	0	0.0%	6	85.7%	0	0.0%	7	100%
USJ 19	2	11.8 %	1	5.9%	1	5.9%	11	64.7%	2	11.8%	17	100%
USJ 20	0	0.0%	0	0.0%	0	0.0%	9	**100.0 %**	0	0.0%	9	100%
USJ 22	0	0.0%	1	16.7%	0	0.0%	3	50.0%	2	33.3%	6	100%
Total	**22**	**5.7%**	**31**	**8.1%**	**14**	**3.6%**	**282**	**73.2%**	**36**	**9.4%**	**385**	**100 %**

A Pearson's correlation was run to assess the relationship between physical activity and neighbourhood environment variables (Table 6) using the self-reported frequency of engagement in physical activity and perception of the neighbourhood environment by 385 respondents in USJ. There was a statistically significant, low negative correlation between physical activity and access to shops ($r = -0.122$, $p < 0.05$), with physical activity explaining 1.2% of the variation in access to shops. For the other neighbourhood environmental variables, they were not significantly correlated to the physical activities.

Table 6. Correlation between Physical Activity and Neighbourhood Environment Variables.

		Access to shops	Safe & well maintained parks	Access to public transport
Physical Activity	Pearson Correlation	**-.122***	-.094	.032
	Sig. (2-tailed)	.017	.066	.526
	N	385	385	385

Note: * Correlation is significant at the 0.05 level (2-tailed).

It shows that satisfaction with the neighbourhood environment was not positively increased by the physical activity level among the respondents. The negative correlation between accessibility to shops/commercial areas and physical activities could be due to people feeling unsatisfied and complaining more about the areas that they often visit. Cunningham et al. (2022) mentioned that popular parks near dense urban areas tend to see heavier foot traffic and wear/tear on facilities, trails, and playgrounds over time. This can turn off loyal patrons. Without changes, variety, or upgrades, the same playgrounds, fields, and courts do not maintain novelty or challenge, which leads to users reporting boredom (Anderson, 2021).

On the other hand, Logue et al. (2020) found that intrinsic motivation, a positive attitude, and high self-efficacy were the strongest individual predictors of meeting weekly exercise guidelines in adults. Even those with limited neighbourhood resources were physically active if they were intrinsically motivated. Furthermore, Lindwall et al. (2021) showed perceived social support, especially from friends, had the strongest association with leisure-time physical activity in older adults after controlling for variables like parks/sidewalks.

4.3. Health Status

Based on the self-reported health condition from the questionnaire survey, it is clear that the majority of the respondents do not have any NCDs (Table 7). The neighbourhood with the highest percentage of respondents having NCDs was USJ 4, with 1/3 of respondents suffering from NCDs. There were a number of neighbourhoods with 100% of respondents who did not suffer from any NCDs, which were USJ 8, 9, 11, 12, 13, 15, 20, and 22.

Table 7. Suffering from any of the NCDs

Area	Yes	%	No	%	Total	%
USJ 1	10	21.28%	37	78.72%	47	100%
USJ 2	6	18.75%	26	81.25%	32	100%
USJ 3	7	23.33%	23	76.67%	30	100%
USJ 4	6	33.33%	12	66.67%	18	100%
USJ 5	2	7.41%	25	92.59%	27	100%
USJ 6	3	7.50%	37	92.50%	40	100%
USJ 8	0	0.00%	17	100.00%	17	100%
USJ 9	0	0.00%	16	100.00%	16	100%
USJ 11	0	0.00%	36	100.00%	36	100%
USJ 12	0	0.00%	11	100.00%	11	100%
USJ 13	0	0.00%	18	100.00%	18	100%
USJ 14	2	9.09%	20	90.91%	22	100%
USJ 15	0	0.00%	5	100.00%	5	100%
USJ 16	2	13.33%	13	86.67%	15	100%
USJ 17	1	8.33%	11	91.67%	12	100%
USJ 18	2	28.57%	5	71.43%	7	100%
USJ 19	1	5.88%	16	94.12%	17	100%
USJ 20	0	0.00%	9	100.00%	9	100%
USJ 22	0	0.00%	6	100.00%	6	100%
Total	**42**	**10.91%**	**343**	**89.09%**	**385**	**1000%**

From the correlation test carried out (Table 8), both the neighbourhood environment and physical activity of respondents were significantly correlated to their health status. Health condition was positively correlated with physical activity (r = 0.104), significant at 0.05 level. Meanwhile, health condition was also positively correlated with neighbourhood environment (r = 0.296), significant at 0.01 level. The relationship between physical activity, neighbourhood environment and health is summarised in Figure 10. Analysis showed that this case study successfully examined the relationship or effect of the neighbourhood environment and physical activity of respondents on the non-communicable health status of respondents, in line with other related research findings. However, the relationship between neighbourhood environment and physical activity was not clearly identified in this study in USJ neighbourhoods.

Table 8. Correlations between Independent Variables and Dependent Variable

	Physical Activity	Health Status	Neighbourhood Environment
Physical Activity	1		
Health Status	**0.104***	1	
Neighbourhood Environment	-0.068	**0.296****	1

Note: * Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

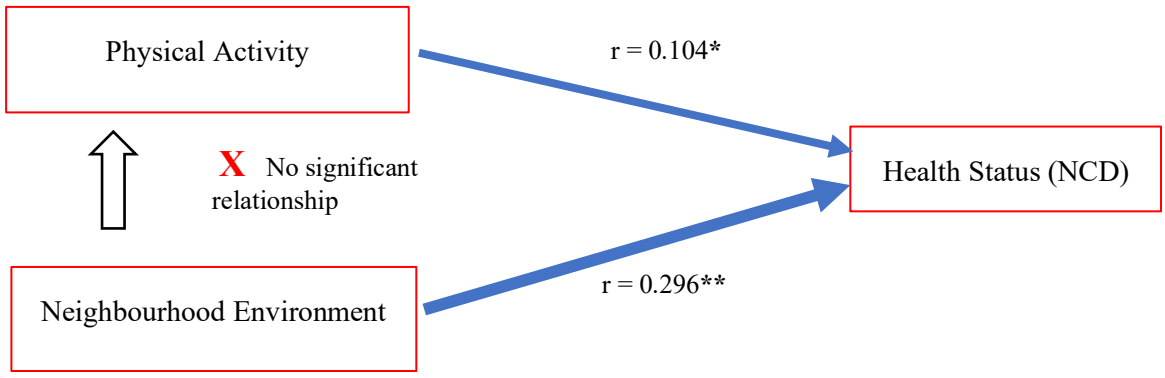

Figure 10. Relationship based on correlation tests

Besides the correlation tests, the multiple regression model was applied to examine the relationship between health affected by the neighbourhood environment and physical activity. **Table 9** illustrates the results of multiple regression for the effect of human health status on the level of physical activity and the neighbourhood environment. The results indicated that the independent variables, the physical activity and the neighbourhood environment, explained 10.3% of the variance in human health status ($R2 = 0.103$, $F = 22.035$, $p < 0.01$). The remaining 89.7% of the variance was explained by variables not included in the model.

The findings showed that the overall model was significant, thus physical activity had a significant effect on human health status ($t (383) = 0.003$, $p = 0.01$). Besides, the p-value of the neighbourhood environment was 0.000 less than $\alpha = 0.01$, so that the neighbourhood environment had a significant effect on human health status ($t (383) = 0.327$, $p < 0.01$). From the findings, it can be concluded that the neighbourhood environment has a higher influence on human health status, followed by physical activity. Meanwhile, a 1-unit increase in physical activity and neighbourhood environment increased health status by 0.003 and 0.327, respectively.

Table 9. Regression for the Relationship of Neighbourhood Environment and Physical Activity with Health

	Unstandardized B	Std. Error	Standardize Beta	T	Significant
Constant	2.210				
Physical Activity	0.003	0.001	0.125	2.576	0.010**
Neighbourhood Environment	0.327	0.052	0.305	6.280	0.000**
R^2	0.103				
F	22.035				
Significant	0.000				

Note: **Significance level: 0.01
Dependent variable: Health Status
Independent variables: Physical activity and Neighbourhood environment

As a result, both correlation and multiple regression show a significant relationship between health and independent variables, which are physical activities and neighbourhood environment. However, the neighbourhood environment was not positively correlated with physical health. A previous study in Shah Alam (Ling et al., 2020) revealed that good urban planning promotes active physical activity among residents, thus reducing the risk of poor health.

5.0 CONCLUSION

This research on the relationship between neighbourhood environment, physical activities, and health using a case study in USJ, Subang Jaya, Selangor State, Malaysia, successfully identified a significant relationship. It is established that the neighbourhood environment significantly affected the health of respondents. The neighbourhood environment was measured by respondents' perceptions and verified by researchers' on-site observations. Meanwhile, the level of physical activities with a focus on vigorous activities significantly affected the health status of NCDs, which were self-reported by respondents via the questionnaire survey.

This research contributed to the body of knowledge, as compared to previous related research. It examined the three relationships in a single study: between neighbourhood environment and physical activity, physical activity and health, and neighbourhood environment and health. Another contribution is covering 19 neighbourhoods in a Malaysian urban settlement with a multi-ethnic community. Finally, the quality of the neighbourhood environment was measured by respondents' perceptions and verified through researchers' on-site observations.

As a contribution to the profession of urban planning and design, the research findings suggested a significant contribution of the neighbourhood environment and human physical activity level to human health (NCD). The neighbourhood environment includes accessibility to public transport and shops, safety, and well-maintained parks. Thus, neighbourhood planning and design should improve the quality and encourage active living via higher involvement in physical activities, especially vigorous activity, to improve human health in relation to NCD.

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